

SAN FRANCISCO BAY AREA WETLANDS ECOSYSTEM GOALS PROJECT

The San Francisco Bay Area Wetlands Ecosystem Goals Project is a comprehensive, science-based program which had developed recommendations regarding where and how much of the various types of wetland should be restored in the Suisun Bay and San Francisco Bay areas. Many of the goals that have been presented are consistent or enhance the ERPP prescriptions to improve the ecological health of processes, habitats, and species in this ecological management zone.

SAN FRANCISCO ESTUARY PROJECT

The San Francisco Estuary Project has four goals to restore the physical, chemical, and biological integrity of the San Francisco Bay-Delta Estuary:

- protect existing wetlands,
- restore and enhance the ecological productivity and habitat values of wetlands,
- expedite a significant increase in the quantity and quality of wetlands, and
- educate the public about the values of wetland resources.

CENTRAL VALLEY PROJECT IMPROVEMENT ACT

Restoring and maintaining ecological processes and functions in the Suisun Marsh and North Bay Ecological Management Zone will augment other important ongoing and future restoration efforts for the zone. With the CVPIA program, the Anadromous Fish Restoration Program (AFRP) of the U.S. Fish and Wildlife Service (USFWS 1997) has a goal to double the natural anadromous fish production in the system over the average production during 1967 through 1991. CVPIA authorized dedicating and managing 800,000 af of CVP yield annually to implement the fish, wildlife, and habitat restoration purposes and measures that include water purchased for inflow to and outflow from the Delta. The CVPIA AFRP includes provisions for restoring habitat and reducing stressors, such as unscreened water diversions.

RECOVERY PLAN FOR SACRAMENTO-SAN JOAQUIN DELTA NATIVE FISHES

The scope of the plan includes San Francisco Bay and the Delta. The intent is to promote conservation of the ecosystems on which the native fishes, such as chinook salmon, delta smelt, longfin smelt, splittail, and Sacramento perch, depend. The plan outlines a strategy for restoration, including actions, The goals, strategies for recovery, and programmatic actions presented in the plan have been adopted by the ERPP. The plan includes targets for populations, habitat restoration, structural changes, and Delta outflow to the Bay that have been included in the ERPP. Important recovery actions in this plan include placing the 2 parts per thousand isohaline (X2 SWRCB standard) at Roe Island, Chipps Island, or at the confluence of the Sacramento-San Joaquin rivers at Collinsville. Suitable placement of the 2 parts per thousand isohaline is key to providing adequate shallow water habitat for delta smelt, longfin smelt, and splittail.

RECOVERY PLAN FOR SALT MARSH HARVEST MOUSE AND CALIFORNIA CLAPPER RAIL

The recovery plan for the salt marsh harvest mouse and clapper rail focuses on protecting existing marshes, creating new marsh habitat with unrestricted tidal sloughs, pickleweed habitat for mice, and suitable nesting habitat for the rail. This recovery plan, prepared and approved in 1984, is being revised by the USFWS. The goals and objectives that are being developed in the revised recovery plan may lead to corresponding adjustments in ERPP targets and programmatic actions.

SUISUN MARSH MANAGEMENT AND PROTECTION PLANS

The Suisun Marsh Management Plan was mandated by the Suisun Marsh Preservation Act of 1977. Its goal is to maximize waterfowl food production while maintaining a diverse marsh flora capable of supporting the present wide variety of wildlife in the marsh. The plans were developed to mitigate (avoid, reduce, or compensate for) the effects on the marsh of the federal Central Valley Project and State Water Project. Though the plan's focus is to manage diked wetlands, plan elements are consistent with ERP

objectives and targets. A primary management area, consisting of 58,000 acres of tidal and managed wetlands, and secondary management areas of 28,000 acres of grasslands, have been identified for management and protection. Restoring tidal wetlands and sloughs in Suisun Marsh will be consistent with Suisun Marsh Management Plan goals.

INTERAGENCY ECOLOGICAL PROGRAM SUISUN ECOLOGICAL WORKGROUP

The Suisun Ecological Workgroup (SEW) was convened at the request of the State Water Resources Control Board as a component of the "Program of Implementation" in the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. SEW is an ad hoc multi-agency/organization work group whose goal is to review the scientific basis for the current salinity standards in Suisun Marsh and make recommendations for comprehensive brackish marsh standards. The primary goals of the SEW are: (1) characterize the brackish water ecosystem for Suisun Marsh, (2) evaluate the effects of existing Western Suisun Marsh water quality standards on beneficial uses, (3) determine and recommend appropriate resource-specific standards, (4) recommend narrative standards for tidal wetlands, (5) assess impacts of implementing appropriate resource-specific standards on other resources, (6) develop appropriate multi-resource (ecosystem) water quality standards, (7) consider alternative models, and (8) recommend future studies and compliance monitoring programs.

CENTRAL VALLEY HABITAT JOINT VENTURE

The Central Valley Habitat Joint Venture is a component of the USFWS's North American Waterfowl Management Plan, with funding and cooperative project participation by federal, State, and private agencies. New funding sources including CALFED restoration funds, are being sought to implement the Joint Venture. The Joint Venture has adopted an implementation plan that includes Suisun Marsh. Objectives include protecting wetlands by acquiring fee-title or conservation easements and enhancing waterfowl habitat in wetlands and agricultural lands. Joint Venture objectives and targets have been adopted by the ERP.

RECOVERY PLAN FOR THE SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON

The winter-run recovery plan is being prepared and will be implemented by the Nation Marine Fisheries Service (NMFS). The draft plan includes recommendations for improving riparian and tidal marsh habitats in the Bay and Delta. ERPP objectives and targets are consistent with those of the recovery plan.

SAN FRANCISCO ESTUARY PROJECT COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN

The San Francisco Estuary project's (SFEP's) purpose is to promote effective management of the Bay-Delta estuary and restore and maintain the estuary's water quality and natural resources. There are eleven programs within the management plan, including wetland management and habitat restoration in the North Bay stream watersheds. Programs include protecting remnant stream habitats and restoring shaded riverine aquatic habitats. Objectives include restoring and creating habitats, including tidal saltmarsh and adjacent upland habitats. A plan is being developed for managing the San Francisco Bay National Wildlife Refuge. Many SFEP and CCMP objectives and targets are included in the ERPP.

AGREEMENT ON SAN JOAQUIN RIVER PROTECTION

In an effort to resolve issues brought forth in the State Water Resources Control Board's 1995 Water Quality Control Plan for the Bay/Delta, the San Joaquin River Tributaries Association, San Joaquin River Exchange Contractors Water Authority, Friant Water Users Authority, and the San Francisco Public Utilities Commission collaborated to identify feasible, voluntary actions to protect the San Joaquin River's fish resources. In spring 1996, these parties agreed on a "Letter of Intent to Resolve San Joaquin River Issues." This agreement, when finalized, has the potential of providing the following:

- higher minimum base flows,
- significantly increased pulse flows,

- installation and operation of a new fish barrier on the mainstem San Joaquin River,
- set up a new biological monitoring program, and
- set aside federal restoration funds to cover costs associated with these measures.

One of the important components of the Agreement is the development of the Vernalis Adaptive Management Program (VAMP) to improve environmental conditions on the San Joaquin River. Elements of this potential adaptive management program include a range of flow and non-flow habitat improvement actions throughout the watershed, and an experimental program designed to collect data needed to develop scientifically sound fishery management options for the future.

CALFED BAY-DELTA PROGRAM

CALFED has funded seven ecosystem restoration projects in the Suisun Marsh/North San Francisco Bay Ecological Management Zone. Two projects screen diversions for managed wetlands on the Suisun Marsh and three restore habitat. A project by the Central Costa County Sanitary District discourages pesticide use by encouraging homeowners to use integrated pest management techniques.

LINKAGE TO OTHER ECOLOGICAL MANAGEMENT ZONES

Restoration efforts in all Ecological Management Zones upstream of the Suisun Marsh and North San Francisco Bay will contribute to the health and recovery of this zone. Likewise, efforts in this zone will contribute to the health of the Delta and salmon and steelhead population recovery in the Sacramento and San Joaquin River basins.

Successfully realizing the vision for this Ecological Management Zone depends, in part, on achieving targets in the Sacramento-San Joaquin Delta, Sacramento River, Eastside Delta Tributaries, and San Joaquin River Ecological Management Zones. These include targets associated with restoring streamflow processes, reducing contaminants, and improving and increasing riparian and wetland habitats. Efforts toward achieving targets in these zones should interact to restore important rearing habitat, reduce the introduction of contaminants, and

control the introduction of non-native aquatic species. For example, essential for meeting the Bay freshwater inflow prescriptions are efforts to meet the individual flow prescriptions for the Sacramento, Feather, Yuba, American, Mokelumne, Stanislaus, Tuolumne, and Merced rivers. Aquatic, riparian, and wetland corridors in the Delta are also directly linked and integral to habitat corridors in Suisun and San Pablo Bays.

RESTORATION TARGETS AND PROGRAMMATIC ACTIONS

ECOLOGICAL PROCESSES

CENTRAL VALLEY STREAMFLOW (FRESHWATER INFLOW)

TARGET 1: More closely emulate the natural seasonal freshwater inflow pattern to North San Francisco Bay to:

- transport sediments,
- allow upstream and downstream fish passage,
- contribute to riparian vegetation succession,
- permit transport of larval fish to the entrapment zone,
- maintain the low salinity zone in Suisun Bay, and
- provide adequate attraction flows for upstream, through-Bay migrating salmon.

Delta outflow in dry and normal years will be improved by coordinating releases and natural flows in the Sacramento River Basin to provide a March flow event of at least 20,000 cfs for 10 days in dry years, at least 30,000 cfs for 10 days in below-normal years, and at least 40,000 cfs for 10 days in above-normal years. The existing smaller, late-April and early-May flow event will be improved with additional water releases from San Joaquin River and Delta tributaries to provide flows of magnitudes and durations similar to those prescribed for March (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to provide target flows in dry and normal years by allowing inflows to major storage reservoirs, prescribed in the visions of upstream Ecological Management Zones, to pass downstream into and through the Delta. (This action would result from an accumulation of

recommendations for spring flow events and minimum flows from upstream Ecological Management Zones.)

RATIONALE: The proposed March supplemental flows were selected as a representative value for impact analysis in the Programmatic EIS/EIR. Throughout the ERP, the need to determine optimal streamflow for ecological processes, habitats, and species is repeated. The issues of supplemental flows are complex in term of ecosystem improvements. The frequency, magnitude, duration, timing and rate of change of streamflows that form channels, create and maintain riparian habitat (including all species of vegetation), and promote all life stages of the various aquatic species dependent on a particular stream will never occur within a single year. An optimal flow regime will have to vary, perhaps significantly, from year to year. The supplemental flow recommendations will be an intensive exercise in adaptive management and must be based on credible scientific underpinnings.

Restoring freshwater flows into Suisun Marsh/North San Francisco Bay Ecological Management Zone consistent with natural hydrologic conditions in the Bay-Delta watershed will help restore fundamental ecosystem processes and functions for the North Bay's aquatic and wetland resources. Increasing spring freshwater inflows will benefit the Bay and help move outmigrating juvenile chinook salmon and steelhead through the Bay toward the ocean. Spring plankton blooms in the North Bay, stimulated by freshwater outflow, support the North Bay's functions as a primary nursery ground for many important fish and crustacean species. These include chinook salmon, striped bass, delta smelt, splittail, Pacific herring, starry flounder, northern anchovy, Dungeness crab, several species of Bay shrimp, and many species of planktonic and benthic invertebrates that make up the Bay's foodweb. Spring freshwater flows also stimulate tidal emergent marsh productivity by providing necessary nutrients and sediments. Freshwater inflows of 20,000 to 40,000 cfs in dry and normal years, compared to the existing 10,000 to 30,000 cfs, would ensure that the low salinity zone of the estuary and X2 would be located well downstream in Suisun Bay, especially in dry years, and allow some fresh water to reach San Pablo Bay through tidal circulation and mixing. (Note: the location of X2 is the distance from the Golden Gate

Bridge to the point at which the daily average salinity is 2 parts per thousand (ppt) at the bottom.)

NATURAL FLOODPLAIN AND FLOOD PROCESSES

TARGET 1: Expand the floodplain area in the Napa River, Sonoma Creek, and Petaluma River Ecological Management Units by putting approximately 10% of leveed lands into the active floodplain (◆◆◆).

PROGRAMMATIC ACTION 1A: Convert leveed lands to tidal wetland/slough complexes.

RATIONALE: Restoring approximately 10% of existing leveed lands to tidal action and floodflows will greatly enhance the floodwater and sediment retention capacity of the area and contribute nutrients for the aquatic foodweb.

BAY-DELTA AQUATIC FOODWEB

TARGET 1: Increase primary and secondary nutrient productivity in the Suisun Marsh/North San Francisco Bay to levels historically observed in the 1960s and early 1970s (◆◆).

PROGRAMMATIC ACTION 1A: Actions described to restore streamflow, floodplains, tidal wetlands and sloughs, and riparian habitat would increase primary and secondary productivity in the Suisun and North San Francisco Bay areas.

PROGRAMMATIC ACTION 1B: Implement an expanded aquatic foodweb research program to understand the linkage of adjacent and transitional wetland habitats better and the aquatic foodweb.

RATIONALE: Increasing the area of tidal wetland/slough habitat will increase primary and secondary productivity. More flooding of floodplains will provide more nutrients and organic carbon inputs.

HABITATS

GENERAL RATIONALE

Restoring tidally influenced wetlands are an essential focus of restoration efforts in the Suisun Marsh/North San Francisco Bay Ecological Management Zone. Habitats of particular interest include tidal perennial aquatic habitat, saline emergent wetlands, and tidal slough habitat. Restoration of these habitats will require a mosaic of habitats including adjacent

habitats that need to be comprised of seasonal wetlands, non-tidal perennial aquatic habitats, perennial grasslands, and riparian habitats. Restoration targets were set with the realization of the difficulty in locating lands for restoration. In the Suisun Marsh, for example, the restoration of tidally influenced habitats will likely require the conversion of existing managed wetlands. The conversion of these existing freshwater wetlands will be offset to the extent possible by restoring existing degraded wetland habitats and by improvement to existing unmanaged wetlands. Likewise, in the San Pablo Bay Ecological Management Unit, restoration of habitat will be constrained by the fact that the area is characterized by open bay and intertidal flats with very limited opportunities for restoration of other shallow water habitat types.

TIDAL PERENNIAL AQUATIC HABITAT

TARGET 1: Restore 1,500 acres of shallow-water habitat in the Suisun Marsh/North San Francisco Bay Ecological Management Zone (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to acquire and restore 1,500 acres of shallow-water habitat in the Suisun Bay and Marsh Ecological Management Unit.

PROGRAMMATIC ACTION 1B: Develop a cooperative program to evaluate the feasibility of restoring shallow-water habitat in the San Pablo Bay Ecological Management Unit.

RATIONALE: Restoring, improving, and protecting high-quality, shallow-water habitat will provide foraging habitat for juvenile fish in this Ecological Management Zone. These areas typically provide high primary and secondary productivity and support nutrient-cycling functions that can sustain high-quality foraging conditions. Opening new areas to tidal flows will also help restore a more natural tidal action to the Bay-Delta. These tide-influenced areas also provide high-quality foraging habitat for waterfowl that use mudflat or submergent vegetation growing in shallow water and diving ducks, such as canvasback and scaup, that consume clams in these areas (Fris and DeHaven 1993, Brittain et al. 1993, Stuber 1984, Schlosser 1991, Sweetnam and Stevens 1993, San Francisco Estuary Project 1992a, U.S. Fish and Wildlife Service 1996, and Lindberg and Marzuola 1993).

Restoration of shallow water habitat in the San Pablo Bay Ecological Management Unit may not be possible as the unit is characterized by open bay and intertidal flats. No lands may be available for restoration.

Development of shallow water habitats in the North Bay will require large-scale tidal restoration to expand and maintain third through fifth order slough channels. Larger sloughs provided the shallow water habitat which existed under historic conditions in the North Bay. Acquiring and restoring diked subsided lands will create shallow water habitats in the short-term. Sedimentation will occur over the long-term and the area will develop into a saline emergent marsh. This objective is probably only achievable in the Napa River, Sonoma Creek, and Petaluma River Ecological Management Units.

NONTIDAL PERENNIAL AQUATIC HABITAT

TARGET 1: Develop 1,600 acres of deeper (3-6 feet deep) open-water areas to provide resting habitat for water birds, foraging habitat for diving ducks and other water birds that feed in deep water (◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to acquire and develop 400 acres of deeper open-water areas adjacent to restored saline emergent wetland habitats in the Suisun Bay and Ecological Management Unit.

PROGRAMMATIC ACTION 1B: Develop a cooperative program to acquire and develop 400 acres of deeper open-water areas adjacent to restored saline emergent wetland habitats in each the Napa River, Sonoma Creek and Petaluma River Ecological Management Units (1,200 acres total).

RATIONALE: Restoring suitable resting areas for waterfowl and other wetland-dependent wildlife species will increase the overwinter survival rate of these populations. Other water-associated wildlife species will also benefit (Madrone Associates 1980).

TIDAL SLOUGHS

TARGET 1: Restore slough habitat for fish and associated wildlife species. Restore 5 miles of slough habitat in the near-term, and 10 miles in the long-term, in the Suisun Bay and Marsh Ecological Management Unit (30-61 acres). Restore 10 miles of slough habitat in the near-term, and 20 miles in the

long-term, in the Napa River Ecological Management Unit (61-121 acres). Restore 10 miles of slough habitat in the near-term, and 20 miles in the long-term, in the Sonoma Creek Ecological Management Unit (61-121 acres). Restore 10 miles of slough habitat in the near-term, and 20 miles in the long-term, in the Petaluma River Ecological Management Unit (61-121 acres) (◆◆).

PROGRAMMATIC ACTION 1A: In association with wetland/marsh restoration efforts, construct sloughs in marsh/slough complexes by acquiring land and purchasing easements.

RATIONALE: Restoring, improving, and protecting slough habitat in the units of the Suisun Marsh/North San Francisco Bay Ecological Management Zone will help sustain high-quality shallow-water habitat that provides spawning habitat for native fish and foraging habitat for rearing juvenile fish. Restoring sloughs, along with tidally influenced freshwater areas and saline emergent marsh, will provide spawning habitat for native fish and foraging habitat for rearing juvenile fish; contribute to high levels of primary and secondary productivity; and support nutrient-cycling functions that can sustain high-quality foraging conditions. These sloughs can also provide resting sites for waterfowl and habitat for the western pond turtle (Simenstad et al. 1992, Lindberg and Marzuola 1993, and Madrone Associates 1980). Tidal sloughs can also provide important loafing sites for waterfowl, particularly diving ducks in the North Bay. The miles of targeted sloughs represent a reasonable restoration level as indicated by maps available from the early 1900s and existing configurations in the Ecological Management Units.

In general, tidal slough restoration should be associated by tidal marsh restoration. Sloughs are a function of the marshes they traverse. The acreage of marsh and soils, sediments, hydrodynamics will limit the amount of tidal marsh that can be restored. These sloughs can also provide loafing sites for waterfowl, particularly diving ducks in the North Bay.

SALINE EMERGENT WETLANDS

TARGET 1: Restore tidal action to 5,000 to 7,000 acres in the Suisun Bay and Marsh Ecological Management Unit; 1,000 to 2,000 acres in the Napa River Ecological Management Unit; 500 to 1,000

acres each in the Sonoma Creek, Petaluma River, and San Pablo Bay Ecological Management Units (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to acquire, in fee-title or through a conservation easement, the land needed for tidal restoration, and complete the needed steps to restore the wetlands to tidal action.

TARGET 2: Protect 6,200 acres of existing saline emergent wetlands in the Suisun Bay and Marsh Ecological Management Zone (◆◆).

PROGRAMMATIC ACTION 2A: Develop a cooperative program to acquire, in fee-title or through a conservation easement, existing wetlands subject to tidal action.

TARGET 3: Restore full tidal action to muted marsh areas along the north shore of the Contra Costa shoreline (◆◆).

PROGRAMMATIC ACTION 3A: Develop a cooperative program to evaluate, acquire, in fee-title or through a conservation easement, and restore existing muted wetlands to full tidal action.

RATIONALE: Restoring tidally influenced saline marsh in this Ecological Management Zone will contribute to increasing levels of primary and secondary productivity and support nutrient-cycling functions that can sustain high-quality foraging conditions (Lindberg and Marzuola 1993, Miller 1993, Simenstad et al. 1992). Increasing the area occupied by saline tidal marsh in each Ecological Management Unit will help support the proper aquatic habitat conditions for rearing and outmigrating juvenile chinook salmon, steelhead, and sturgeon and rearing delta smelt, striped bass, and splittail. Restoring high-quality saline marshes, both tidal and nontidal, will contribute to nutrient cycling, maintaining the foodweb, and supporting enhanced levels of primary and secondary production. Increasing the area occupied by nontidal saline marsh will contribute to subsidence control and island accretion (growth) efforts. Permanent saline marsh can help arrest and, in some cases, reverse subsidence where peat oxidation has lowered land elevations to more than 15 feet below sea level. Increasing the area occupied by saline marsh will contribute to an ecosystem that can accommodate sea-level rise and provide a more natural tidal pattern and associated benefits to the foodweb and water quality of the Bay

and Delta. Habitat conditions for wetland-associated wildlife will be improved.

The targets for saline emergent wetlands will probably be achieved or even exceeded by several ongoing programs. These include activities to restore saline emergent wetlands which are contained within land acquisition programs by the U.S. Fish and Wildlife Service and Department of Fish and Game.

SEASONAL WETLANDS

TARGET 1: Assist in protecting and enhancing 40,000 to 50,000 acres of existing degraded seasonal wetland habitat in the Suisun Bay and Marsh Ecological Management Unit per the objectives of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan. (◆◆◆).

PROGRAMMATIC ACTION 1A: Support the cooperative program to improve management of up to 26,000 acres of degraded seasonal wetland habitat in the of the Suisun Bay and Marsh Ecological Management Unit.

PROGRAMMATIC ACTION 1B: Support the development of a cooperative program to improve management of up to 32,000 acres of existing seasonal wetland habitat in the Suisun Bay and Marsh Ecological Management Unit.

TARGET 2: Acquire and convert 1,000 to 1,500 acres of existing farmed baylands in the Suisun Marsh to seasonal wetlands (◆◆).

PROGRAMMATIC ACTION 2A: Develop a cooperative program to acquire, in fee-title or through a conservation easement, existing farmed baylands and restore tidal action.

RATIONALE: Restoring wetland and riparian habitats in association with aquatic habitats is an essential restoration strategy element for this Ecological Management Zone. This restoration is fundamental to supporting the foodweb and enhancing conditions for rearing chinook salmon, steelhead, sturgeon, juvenile delta smelt, striped bass, and splittail. Foodweb support functions for wildlife will also benefit (Cummins 1974, Brostoff and Clark 1992).

Seasonal wetlands can help reduce concentrations and loads of pesticide residues in water and sediments, which help to reduce sublethal and long-term

impacts of specific contaminants for which it is difficult to document population-level impacts conclusively. Modifying agricultural practices and land uses on a large scale will reduce the concentrations of pesticide residues through a combined approach. This approach involves reducing the amount of pesticide applied and the amount reaching aquatic Suisun Marsh and San Francisco Bay habitats. This will be done by biological and chemical processes in wetland systems that break down harmful pesticide residues. Improved inchannel flows in this Ecological Management Unit resulting from seasonal reductions in water use and enhanced environmental water supplies will also help to reduce contaminant concentrations (San Francisco Estuary Project 1992a).

Restoring high-quality freshwater marsh and brackish marsh, both seasonal and permanent, will increase the production and availability of natural forage for waterfowl and other wildlife. It will increase the overwinter survival rates of wildlife populations in this Ecological Management Zone and improve their body condition before they migrate. As a result, breeding success will be improved. Managing these habitats will also reduce the amount and concentrations of contaminants that could, upon entering the sloughs, interfere with efforts to restore aquatic ecosystem health.

Target 1 "enhance 40,000 to 50,000 acres of degraded seasonal wetland habitat" is consistent with the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan. Programmatic Action 1A "enhance 26,000 acres of degraded seasonal wetland habitat" is already being implemented by Ducks Unlimited as part of a grant through the North American Wetlands Conservation fund. The intent of the ERPP is to remove the levees of some managed wetlands to allow the restoration of tidally influenced habitats and expand the acreages of wet meadows or pastures. The greatest need to restore where possible, tidal wetland areas. This may result in a need to replace any losses of managed wetlands by creating additional wetland areas. However, there may not be area for any additional acres of managed wetlands as the majority of agricultural lands have already been converted to managed wetlands. For example, the following figures provided by the Suisun Resource Conservation

District display the possible difficulty in creating additional managed wetlands.

<u>Existing Land Use</u>	<u>Existing Acreage</u>
managed wetlands	52,000 acres
unmanaged tidal wetlands	6,300 acres
bays and sloughs	30,000 acres
uplands and grasslands	27,700 acres

VERNAL POOL

TARGET 1: Protect and manage vernal pools in the Suisun Bay and Marsh Ecological Management Unit that provide suitable habitat for listed fairy shrimp species, the Delta green ground beetle, and special-status plant species to assist in these species' recovery (◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to acquire and manage 100 acres of vernal pools and 500 to 1,000 acres of adjacent buffer areas

TARGET 2: Restore vernal pools that have been degraded by agricultural activities to provide suitable habitat for special-status invertebrates and plants and amphibian, such as the spadefoot toad, to assist in the recovery of these populations (◆).

PROGRAMMATIC ACTION 2A: Develop a cooperative program to restore the quality of vernal pools and their adjacent habitats.

RATIONALE: Restoring wetland, riparian, and adjacent upland habitats in association with aquatic habitats is an essential restoration strategy element for the Suisun Marsh/North San Francisco Bay Ecological Management Zone. Restoring this habitat mosaic on a large scale will help restore ecosystem processes and functions and provide additional protection to listed species associated with this habitat type.

RIPARIAN AND SHADED RIVERINE AQUATIC HABITATS

TARGET 1: Restore 10 to 15 linear miles of riparian habitat along riparian scrub and shrub vegetation corridors in each Ecological Management Unit. In this restored habitat, 60% should be more than 15 yards wide, and 40% should be no less than 5 yards wide and 1 mile long(◆◆◆).

PROGRAMMATIC ACTION 1A: Coordinate with landowners and managers to restore and maintain 10 to 15 linear miles of riparian habitat along corridors

of riparian scrub and shrub vegetation in each Ecological Management Unit. Of this, 60% should be more than 15 yards wide, and 40% should be no less than 5 yards wide and 1 mile long (40-60 acres in each of 5 units).

RATIONALE: Many wildlife species, including several species listed as threatened or endangered under the State and federal Endangered Species Acts (ESAs) and several special-status plant species in the Central Valley, depend on or are closely associated with riparian habitats. Riparian scrub and shrub will help provide needed escape cover for these species during high-flow periods. Riparian vegetation in the western portion of the Suisun Marsh/North San Francisco Bay Ecological Management Zone is limited by water salinity. Riparian restoration will most likely occur in the upper reaches of the Ecological Management Units in areas that may be tidally influenced but which have low salinity.

ESSENTIAL FISH HABITAT

TARGET 1: Maintain and improve existing freshwater fish habitat and essential fish habitat through the integration of actions described for ecological processes, habitats, and stressor reduction or elimination (◆◆).

PROGRAMMATIC ACTIONS: No additional programmatic actions are recommended.

RATIONALE: Freshwater fish habitat and essential fish habitat are evaluated in terms of their quality and quantity. Actions described for Delta ecological processes, stressor reduction, and riparian and riverine aquatic habitat should suffice to maintain and restore freshwater fish habitats. For example, maintaining freshwater and essential fish habitats is governed by actions to maintain streamflow, improve coarse sediment supplies, maintain stream meander, maintain or restore connectivity of rivers and streams and their floodplains, and in maintaining and restoring riparian and riverine aquatic habitats.

PERENNIAL GRASSLANDS

TARGET 1: Restore 1,000 acres of perennial grasses in each Ecological Management Unit associated with existing or proposed wetlands (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to restore perennial grasslands

by acquiring conservation easements or purchasing land from willing sellers.

RATIONALE: Restoring wetland, riparian, and adjacent upland habitats in association with aquatic habitats is an essential restoration strategy element for this Ecological Management Zone. Eliminating fragmentation and restoring connectivity will enhance habitat conditions for special-status species,

such as the Suisun song sparrow, California black rail, and salt marsh harvest mouse. For instance, the habitats for these species have been degraded by the loss of adjacent, suitable escape cover that is needed by the salt marsh harvest mouse during periods of high flows or high tides. Fragmentation has also interfered with daily and seasonal migratory movements and genetic interchange within the population (Novick and Hein 1982).

Table 7: Summary of ERPP Habitat Restoration Targets for the Suisun Marsh/ North San Francisco Bay Ecological Management Zone.

Habitat Type	Suisun Bay and Marsh	Napa River	Sonoma Creek	Petaluma River	San Pablo Bay	Total
Tidal Perennial Aquatic	1,500	— 0	0	0	Feasibility study	1,500 acres
Nontidal Perennial Aquatic (deep, open water)	400	400	400	400	0	1,600 acres
Tidal Sloughs	5-10 miles (30-61 acres)	10-20 miles (61-121 acres)	10-20 miles (61-121 acres)	10-20 miles (61-121 acres)	0	35-70 miles (213-424 acres)
Saline Emergent Wetland (restore)	5,000-7,000	1,000-2,000	500-1,000	500-1,000	500-1,000	7,500 -12,000 acres
Saline Emergent Wetland (protect)	to be determined (TBD)	TBD	TBD	TBD	TBD	6,200 acres
Seasonal Wetland (Protect existing)	40,000-50,000	0	0	0	0	40,000-50,000 acres
Seasonal Wetland (Restore)	1,000-1,500	0	0	0	0	1,000-1,500 acres
Vernal Pools	100	0	0	0	0	100 acres
Vernal Pool Buffer Area	500-1,000	0	0	0	0	500-1,000 acres
Riparian and Riverine Aquatic	10-15 miles (40-60 acres)	10-15 miles (40-60 acres)	10-15 miles (40-60 acres)	10-15 miles (40-60 acres)	10-15 miles (40-60 acres)	50-75 miles (200-300 acres)
Perennial Grassland	1,000	1,000	1,000	1,000	1,000	5,000 acres
Total acres of all habitats to be restored include tidal perennial, nontidal perennial saline emergent wetland, seasonal wetland, vernal pool and vernal pool buffer, and perennial grassland.					17,200-22,700 acres	
Total acres of existing habitats to be protected and enhanced					46,200-56,200 acres	
Total miles of tidal sloughs to be restored					35-70 miles (213-424 acres)	
Total miles of riparian and riverine aquatic habitat to be restored					50-75 miles (200-300 acres)	

REDUCING OR ELIMINATING STRESSORS

WATER DIVERSIONS

TARGET 1: Reduce entrainment losses of juvenile fish at diversions by 25 to 50% by installing positive-barrier fish screens on large diversion structures (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to consolidate, screen, or eliminate diversions in the Suisun Marsh/North San Francisco Bay Ecological Management Zone.

PROGRAMMATIC ACTION 1B: Evaluate opportunities to use alternative means to provide cooling water at the Pittsburg power plant.

RATIONALE: Large diversions on the main channels of Suisun and San Pablo Bays and adjoining marsh/slough complexes entrain juvenile and small adult fish at rates that could be detrimental to the survival of species of special concern (Chadwick and Von Geldern 1964, 1974; Larkin 1979; and Erkkila et al. 1950). The reduction target reflects preliminary data indicating that entrainment through the smallest diversions on small channels might not pose a significant threat to the successful restoration of Bay-Delta health. The success of screening in the estuarine zone is difficult and dependent on critical protective operations and facilities. For example, bypass flows or bypass systems are needed to move target species away from the zone of influence and into areas safe from entrainment.

For many years the entrainment and loss of juvenile fish at the Pittsburg power plant has been overlooked as a source of juvenile mortality. This potential stressor should be reevaluated and actions should be recommended to reduce fish losses if appropriate.

INVASIVE AQUATIC PLANTS

TARGET 1: Manage existing and restored dead-end and open-end sloughs and channels within the Ecological Management Zone so that less than 1% of the surface area of these sloughs and channels is covered by invasive non-native aquatic plants (◆◆).

PROGRAMMATIC ACTION 1A: Conduct large-scale, annual weed eradication programs throughout existing and restored dead-end and open-end sloughs and channels in each Ecological Management Unit so

that less than 1% of the surface area of these sloughs and channels is covered by invasive non-native aquatic plants within 10 years.

RATIONALE: Invasive aquatic plants have altered ecosystem processes, functions, and habitats by modifying the foodweb and competing for nutrients, light, and space. Nesting birds are particularly vulnerable to increased predation from non-native ground-dwelling predators and competition from non-native nest parasites. Actions taken in the Suisun Marsh/North San Francisco Bay Ecological Management Zone to address this objective are prescribed primarily to enhance foodweb functions and improve habitat conditions for resident, estuarine, and anadromous fish and neotropical migratory birds. This can be accomplished, in part, by reducing the area inhabited by invasive non-native plants and by restoring large areas of optimal nesting habitat (Dudley and D'Antonio 1994, Anderson 1990, Zedler 1992, and Bay-Delta Oversight Council 1994).

INVASIVE AQUATIC ORGANISMS

TARGET 1: Reduce or eliminate the influx of non-native aquatic species in ship ballast water (◆◆◆).

PROGRAMMATIC ACTION 1A: Fund additional inspection staff to enforce existing regulations.

PROGRAMMATIC ACTION 1B: Help fund research on ballast water treatment techniques that could eliminate non-native species before ballast water is released.

TARGET 2: Reduce the potential for influx of non-native aquatic plant and animal species at border crossings (◆◆◆).

PROGRAMMATIC ACTION 2A: Provide funding to the California Department of Food and Agriculture to expand or establish, as appropriate, a comprehensive program to exclude, detect, and manage invasive aquatic species, such as zebra mussel.

RATIONALE: Every reasonable effort should be made to reduce the introduction of non-native organisms in the ballast water of ships that enter the Delta. Such organisms have greatly altered the zooplankton of the Delta over the past several